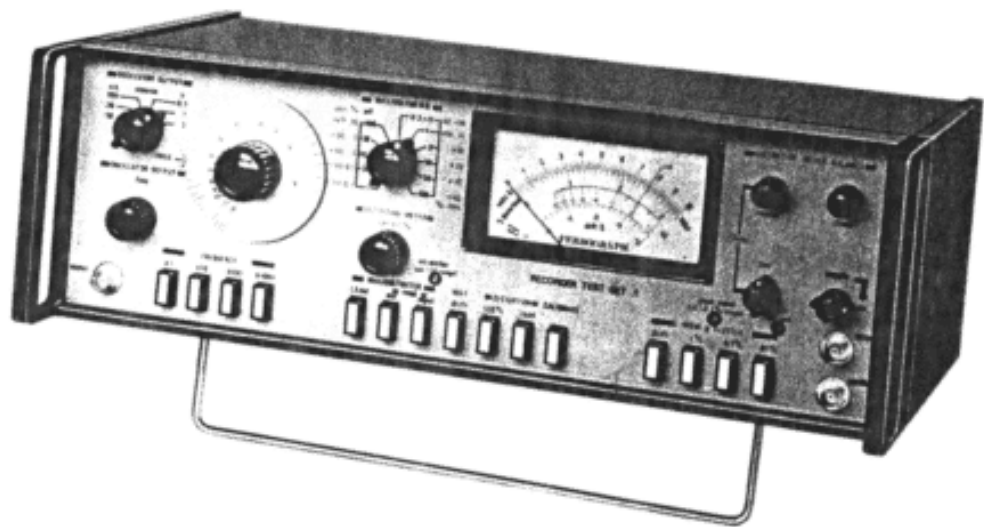


Ferrograph_RTS2_Recorder_Test_Set_SM

OPERATING INSTRUCTIONS



FERROGRAPH
RECORDER TEST SET
RTS2

Contents

	<i>Page No.</i>
WHAT IT IS	2
WHAT IT DOES	3
WHAT IT CONTAINS	4
OPERATING INSTRUCTIONS	
1. CONNECTING UP AND SWITCHING ON	
1.1. Power Supply Connections	5
1.2. Signal Connections	5
1.3. Switching On and Off	5
2. CHECKING AND ADJUSTING CALIBRATION	
2.1. General	5
2.2. Millivoltmeter Calibration	6
2.3. Drift Calibration	6
2.4. Wow and Flutter Calibration	6
3. MAKING MEASUREMENTS	
3.1. Preparing to Measure	7
3.2. Measuring Frequency Response	7
3.3. Measuring Drift	8
3.4. Measuring Wow and Flutter	8
3.5. Measuring Distortion	9
3.6. Measuring Signal-to-Noise Ratio	10
3.7. Measurement of Gain	12
TECHNICAL SPECIFICATION	13

THE FERROGRAPH COMPANY LIMITED
AURIEMA HOUSE, 442 BATH ROAD, CIPPENHAM, SLOUGH, BUCKS SL1 6BB
AND SIMONSDALE WORKS, SOUTH SHIELDS

FERROGRAPH

RECORDER TEST SET
RTS2

What it is

The Ferrograph Recorder Test Set, RTS2, is a compact and inexpensive instrument that enables all the essential performance parameters of a magnetic tape recorder to be measured. It is supplied complete with a power supply lead, signal input and output leads, a 40 dB attenuator and a test tape. Except for a power supply, nothing extra is needed in order to make a wide range of measurements, including :—

Frequency Response	Signal-to-noise Ratio
Distortion	Wow and Flutter
Drift	Gain
Sensitivity	

The Test Set is equally useful for carrying out similar measurements on other audio apparatus, including amplifiers, disc reproducers and sound-on-film equipment.

FERROGRAPH

RECORDER TEST SET

RTS2

What it does

The Recorder Test Set, RTS2 is intended primarily for use by those concerned with operating and maintaining tape recorders and similar equipment; it provides them with a ready means of determining the standard of performance reached by a given machine or item of equipment in all the respects mentioned in the preceding section.

To enable so many different kinds of measurement to be carried out by a single inexpensive instrument, it has been necessary to rationalise the design so that the essential minimum of electronic circuitry is re-arranged into various circuit configurations by means of push-buttons. This also has the effect of making the Test Set notably simple and quick to operate.

In the interest of simplicity and cheapness, it has also been necessary to eliminate a number of features that, desirable though they may be for laboratory standardisation or investigational measurements, are not essential for the purposes for which this Test Set is intended. Thus, both input and output circuits are unbalanced† and the single indicating instrument is an average meter calibrated in r.m.s. values for sinusoidal signals. Also, total harmonic distortion is measured by means of a fundamental-rejection filter: this is all that is required for determining whether mid-band distortion is within proper limits and for establishing the 2% or 3% distortion levels from which signal-to-noise ratios are usually reckoned.

Nevertheless, in spite of this rigorous simplification, the Recorder Test Set contains its own built-in facilities for checking calibration in each of its various modes without the use of external equipment. In addition, the distortion and the wow and flutter signals are not only measured by the meter but are also available on a socket on the front panel. Consequently, the use of the Test Set as an investigational tool can be extended by the use of additional external equipment such as an oscilloscope, a wave analyser or filters.

†With the addition of a RTS Auxiliary Unit, balanced input and outputs are also available.

FERROGRAPH

RECORDER TEST SET RTS2

What it contains

The Recorder Test Set, RTS2, consists essentially of three parts:—

- (1) A power supply unit that enables the instrument to operate on alternating current of either 105 to 120 volts or 200 to 250 volts and at either 50 Hz or 60 Hz.
- (2) A variable frequency oscillator and variable attenuator that enable a sine wave test signal (15 Hz to 150 kHz and about 0.03 mV to 3V) to be fed (from the Test Set's "oscillator" socket) to the equipment under test.
- (3) A millivoltmeter which, with its associated electronics, measures either the output from the equipment under test (fed into the Test Set's "meter" socket) or the output signal of the Test Set itself.

The electronics associated with the millivoltmeter are selected by push buttons on the front panel, to enable it to measure:—

- (a) voltages in the range 1 mV to 100 V, full scale deflection.
- (b) the distortion products of a sinusoidal test signal in the range 400 to 1100 Hz approx. For this purpose a tunable fundamental-rejection filter is switched into circuit.
- (c) drift and peak wow and flutter weighted to D.I.N. 45507. When switched for these measurements, the Test Set provides a 3.15 kHz* test signal from its "oscillator" socket.

In addition, the Test Set contains built-in facilities for checking and, if necessary, adjusting calibration for each type of measurement.

*Note: Model RTS2A provides a 3 kHz test signal.

FERROGRAPH
RECORDER TEST SET
RTS2

Operating Instructions

1. CONNECTING UP AND SWITCHING ON

1.1. Power Supply Connections

Check whether the voltage selector at the back of the Test Set is set to the appropriate voltage range, 105-120 V or 200-250 V. If it is not, pull the selector knob outwards, rotate it to the required position and then press it home again firmly but gently.

No adjustment for supply frequency in the range 50-60 Hz (approx.) is required.

The power lead attached to the Test Set should be connected, through an appropriate plug, to the power supply (A.C. only).

1.2. Signal Connections

The BNC socket marked "oscillator" should be connected to the input of the equipment under test.

If the external 40 dB Attenuator is required, the 'flying' lead should be connected to the "oscillator" socket and the connecting cable to the Attenuator.

The BNC socket marked "meter" should be connected to the output of the equipment under test.

Note 1. Cables for connecting the Test Set to the Line Input and Line Output sockets of a Ferrograph Series 7 recorder are supplied. These leads are irreversible and ensure that the 'earthy' sides of the Test Set and the recorder input and output circuits are connected together. When other leads or other end connectors are used, care must be taken to ensure that this condition still obtains.

Note 2. Since the Test Set has a common earth path between input and output sockets, great care should be taken to ensure that this does not result in a small part of the audio output current flowing through the input earth. When high sensitivity inputs are being used, this could give rise to spurious noise or distortion readings. These can usually be prevented by the insertion of a small resistor (*e.g.* 100 ohm) in series with the "meter" input earth lead.

1.3. Switching On and Off

The Test Set is switched on by turning to "on" the "SUPPLY" knob at the right of the front panel. The meter is illuminated to show when power has been applied.

2. CHECKING AND ADJUSTING CALIBRATION

2.1. General

For this purpose it does not matter whether the Test Set is connected to the equipment to be tested or not. It is recommended, however, that the power supply should have been switched on for at least 5 minutes before calibration in the Drift and the Wow and Flutter modes is checked.

The adjustments are not interdependent and can be carried out individually.

After the Test Set had been switched on, the procedures are as follows :—

FERROGRAPH

RECORDER TEST SET

RTS2

2.2. Millivoltmeter Calibration

- (1) Set the "MILLIVOLTMETER" switch to the "1 V" position.
- (2) Press down the "read input" push button. (This releases the button to its left and the three buttons to its right.)
- (3) Press down the "CALIBRATE" push button.
- (4) The meter pointer should now lie on the CAL mark above the outer scale. If it does not, adjust it to do so by means of the screwdriver-operated control marked "mV meter cal (1 V range)".
- (5) Press the "CALIBRATE" push button to release it.

Note: When this adjustment has been carried out, the meter, with the "MILLIVOLTMETER" switch in the "1 V" position, measures voltage on the top scale with full scale deflection of 1 V. Movement of the "MILLIVOLTMETER" switch adjusts the meter sensitivity to give full scale deflection for inputs of 1 mV to 100V, as indicated on the switch, reading on the appropriate one of the two upper scales.

For setting the meter to read arbitrarily, see 3.4, below.

2.3. Drift Calibration

- (1) Press down the "W & F drift" push button. This releases the two buttons on either side and applies a 3.15 kHz* test signal to the "oscillator" socket and to the meter circuits.
- (2) Press down the "CALIBRATE" and the "WOW & FLUTTER drift" push buttons (thus releasing the "1%", "0.3%" and "0.1%" buttons).
- (3) The meter pointer should now read 0 on the "drift %" scale. If it does not, adjust it to do so by means of the screwdriver-operated, pre-set control marked "drift set zero".
- (4) Press down the "CALIBRATE" push button to release it.

The meter will now measure drift directly on the "drift %" scale.

2.4. Wow and Flutter Calibration

- (1) With the "W & F drift" push button still pressed down (see above), press down the "CALIBRATE" and the "0.3%" push buttons (releasing the "drift", "1%" and "0.1%" buttons).
- (2) The meter pointer should now lie on the CAL mark above the top scale. If it does not, adjust it to do so by means of the screwdriver-operated pre-set control marked "peak wow cal (0.3% range)".
- (3) Press down the "CALIBRATE" push button to release it.

The meter will now read percentage wow and flutter (0.3% f.s.d.) on the next to top scale.

Pressing down the "1%" or "0.1%" button will release the "0.3%" button and the meter will then read percentage wow and flutter on the top scale with f.s.d. 1% or 0.1%.

FERROGRAPH

RECORDER TEST SET

RTS2

3. MAKING MEASUREMENTS

3.1. Preparing to Measure

In the following it is assumed that the gain controls on the equipment under test have been set for normal operating conditions. It is also assumed that the input and output signal voltages under these conditions are, at least approximately, known. If this is not the case then, initially, the "OSCILLATOR OUTPUT coarse" switch should be set to its lowest (10 mV) position and the "MILLIVOLTMETER" switch to its highest (100 V) position. When connecting to a microphone input socket, the external 40 dB Attenuator should be inserted between the Test Set and the equipment under test (see 1.2).

The "OSCILLATOR OUTPUT coarse" control should then be turned clockwise, step by step, until a proper operating level has been obtained. If this requires the "OSCILLATOR OUTPUT coarse" control to be set higher than 3V, then the 40 dB Attenuator should be removed from the output. (When testing a Ferrograph Series 7 recorder this is shown by the reading of the VU meter when it is switched to *Source*.)

With a proper output level from the equipment under test (shown on a Ferrograph Series 7 recorder by the reading of the VU meter when it is switched to *Tape*) the "MILLIVOLTMETER" switch on the Test Set should be turned a anti-clockwise step by step, until a convenient reading on the meter is obtained.

3.2. Measuring Frequency Response

- (1) Set the "OSCILLATOR OUTPUT coarse" switch to an appropriate position (see 3.1 above) and the "OSCILLATOR OUTPUT fine" control to about mid-position.
- (2) Set the "FREQ" control to 100 and press down the "FREQUENCY" range selecting button below it marked "X 10".

The Test Set is now delivering a 1 kHz test signal to the equipment under test. The level of this signal can be controlled in steps by the "OSCILLATOR OUTPUT coarse" control and, continuously, by the "OSCILLATOR OUTPUT fine" control. Once adjusted at 1 kHz, the adjustment must not be varied throughout the rest of this test.

- (3) Press down the "input" push button and check that the "LF cut" and "CALIBRATE" buttons are both released.

The Test Set will now measure the output voltage from the equipment under test (see Note to 2.2.).

- (4) The frequency of the test signal can be changed by means of the "FREQ" control and the range selecting push buttons below it. The output level at various frequencies can be read on the meter, its sensitivity being increased or decreased, if required, by use of the "MILLIVOLTMETER" switch (see Note to 2.2.).

A plot of output voltage against frequency shows the frequency response of the equipment under test.

Note 1: When making frequency response and similar measurements, it is usually convenient to have the meter reading 0 on the dB scale, or some other round number, at a chosen reference frequency, say 1 kHz. Normally this is done by using the "OSCILLATOR OUTPUT fine" control to adjust the level of the input signal to the equipment under test or by a fine adjustment of its gain control.

FERROGRAPH

RECORDER TEST SET

RTS2

When neither of these things can be done, as, for example, when reproducing a pre-recorded tape on equipment with no output level control, the meter reading may be adjusted to a convenient reference value by pressing down the "DISTORTION set 100%" push button (thus releasing the "input" push button) and adjusting the meter to the required reading by use of the "DISTORTION METER set 100%" control. The meter will now indicate relative levels e.g. in decibels, at the various frequencies but it will not, of course, read in volts or millivolts.

The "MILLIVOLTMETER" control should only be used on the distortion meter ranges of "0.3%" to "100%". In view of the extreme sensitivity ($100\mu\text{V}$) of the "0.1%" range, this should not be used for reading voltages with the "DISTORTION 100%" button pressed.

Note 2: When making frequency response measurements on magnetic tape recorders, it is essential that the input signal level shall be at least 20 dB below that which will give full level recording at 1 kHz. Similar restrictions on the permissible level of test signals apply to some other types of equipment.

Note 3: When testing a tape recorder that cannot record and reproduce simultaneously, it is necessary first to record a series of test frequencies (with a fixed input signal level) and then to measure output levels at the various frequencies when this recording is reproduced.

The above procedures will measure the overall response of a tape recorder. To determine whether the reproducing frequency response is correct, it is necessary to measure the output levels at various frequencies when reproducing a standard test tape on which the various frequencies have been recorded at the levels prescribed by the appropriate Standard.

3.3. Measuring Drift

- (1) Press down the "W & F drift" button and also the "drift" button under the "WOW & FLUTTER" heading.

The Test Set is now delivering a 3.15 kHz* test signal to the recorder under test.

- (2) Set the recorder controls so that this signal is recorded at a normal level for, say, 40 seconds. Stop the machine, and rewind the tape to the beginning of the recording.
- (3) Reproduce this recording.

Note: The level of the signal reaching the Test Set should not be less than 75 mV. To check this, see Note 1 to 3.4.

- (4) The meter will now indicate directly on the "drift %" scale the percentage difference between the frequency of the reproduced signal and the 3.15 kHz* test signal that was recorded.

Note: When testing a disc reproducer it will be necessary, and when testing a tape reproducer it may be convenient, to reproduce a test recording made on another machine. The indicated percentage drift may then be due partly to a difference in the recording and reproducing speeds and partly to the original signal not having been 3.15 kHz*.

3.4. Measuring Wow and Flutter

- (1) If it has not already been done, first prepare a test recording as in (1) and (2) of 3.3. above.

FERROGRAPH

RECORDER TEST SET

RTS2

- (2) Press down the "1%" button under the "WOW & FLUTTER" heading (releasing the adjacent "drift" button) and reproduce the test recording (see Note 1 below).

The meter will now indicate wow and flutter on the top scale; f.s.d. 1%. If the meter reading is inconveniently small, press down the "0.3%" or "0.1%" button (releasing the "1%" button). The meter will now indicate wow and flutter on the next to top scale with f.s.d. 0.3% or on the top scale with f.s.d. 0.1%.

Note 1: For proper operation of the limiter (which ensures that amplitude variations do not affect the readings), the reproduced voltage reaching the Test Set should be more than 75 mV. This can readily be checked by pressing down the "MILLIVOLTMETER read input" button (releasing the adjacent "W & F drift" button) and determining the level from the combined readings of the meter and the "MILLIVOLTMETER" switch (see Note to 2.2.). After such a level check, the "W & F drift" button must, of course, be pressed down again to measure wow and flutter.

Note 2: For a proper measurement of wow and flutter, the frequency of the signal fed to the Test Set should be within about $\pm 5\%$ of the nominal value, 3.15 kHz*. When reproducing a test recording just made on the same machine, as above, it will almost always be within the $\pm 2\%$ indicated directly on the "drift %" scale. This may not be the case when reproducing a test recording made on a different machine or at another time but satisfactory measurements of wow and flutter can still be made if, when measuring drift, the meter can be made to read within its $\pm 2\%$ range by use of the "drift set zero" control.

Note 3: Readings of wow and flutter taken while the test recording is being made usually give a fair indication of magnitude but do not give the true values since speed fluctuations that repeat in a period corresponding to the time taken by the tape to move from the record to the replay head do not appear.

3.5. Measuring Distortion

For this measurement, the output signal from the equipment under test should preferably be greater than 100 mV (see Note 3 below).

The procedure is as follows:—

- (1) Set the "MILLIVOLTMETER" switch to "1 V".
- (2) Set the "FREQ" control to 100 and press down the range selecting push button marked "X 10".

A 1 kHz test signal is now delivered to the equipment under test.

- (3) Press the "DISTORTION set 100%" button.
- (4) Now use the "DISTORTION METER set 100%" control knob to adjust the meter to read 10 on the top scale.
- (5) Press the "DISTORTION read" button (releasing the "DISTORTION set 100%" button). Also press down the "LF cut" button.

FERROGRAPH

RECORDER TEST SET

RTS2

- (6) Set the "DISTORTION METER BALANCE fine" control to about mid-position (vertical) and then use the "freq-coarse" control and the "phase" control to reduce the meter reading to a minimum.

During this process, the meter sensitivity should be progressively increased, by means of the "MILLIVOLTMETER" switch, as required to maintain a convenient reading. Complete the adjustment for minimum reading by use of the "freq-fine" control and the "phase" control.

- (7) The percentage distortion can now be read on the appropriate one of the two upper scales in combination with the % markings on the "MILLIVOLTMETER" switch.

Note 1: The test signal need not be 1 kHz, as above, but it should be within the range 400 - 1100 Hz, approximately. Otherwise, a minimum will not be obtained within the range of the "BALANCE" controls.

Note 2: The meter reading includes signals of all frequencies between 30 Hz and 20 kHz except for the test frequency and a narrow band on either side of it. It therefore includes hum and other low frequencies. Pressing down the "LF cut" button cuts the lower frequencies progressively below 400 Hz.

Note 3: If a level of 100 mV or more cannot be obtained from the equipment under test, it will not be possible to adjust the meter to full scale deflection as in (4) above. The measurement may still be carried out but with the "MILLIVOLTMETER" switch set below 1V, with a corresponding allowance in the calculation of percentage and with a restriction in the lowest level of distortion that can be measured.

Note 4: When testing a tape recorder that cannot record and reproduce simultaneously it is, of course, necessary first to record the test signal and then to measure distortion while it is being reproduced.

3.6. Measuring Signal-to-Noise Ratio

- (1) With the equipment under test working at normal operating levels, measure the total harmonic distortion on a 1 kHz test signal as in 3.5. above.
- (2) If the total harmonic distortion is less than 2%, then increase the level of the test signal by means of the "OSCILLATOR OUTPUT" "coarse" and "fine" controls (or, if testing a tape recorder, the recording gain control) until the distortion is 2%.

Note: A good idea of the rate of increase of distortion with signal level can be obtained by successively decreasing meter sensitivity and increasing signal level in steps of 10 dB but, for the final determination of distortion, the full procedure of 3.5. should be carried out.

- (3) With the equipment under test adjusted so that total harmonic distortion of a 1 kHz output signal is 2%, press the "MILLIVOLTMETER input" button (releasing the "DISTORTION read" button).
- (4) Adjust the "MILLIVOLTMETER" switch to give a convenient meter deflection. The reading of the meter, in combination with the switch (see Note to 2.2.), indicates the output level at which there is 2% distortion.

FERROGRAPH

RECORDER TEST SET

RTS2

- (5) Remove the signal from the input of the equipment under test and apply a short circuit (But see Note 2 below).
- (6) Press the "LF cut" button to release it. (But see Note 5 below).
- (7) Increase the meter sensitivity, by means of the "MILLIVOLTMETER" switch, until a convenient reading is obtained. The number of millivolts indicated by the combined meter and switch readings [(see Note 2.2) is the total noise level. The ratio of this to the voltage determined in (3) above, is the Signal-to-Noise Ratio, usually stated in decibels.

Note 1: When determining the 2% distortion level of a tape recorder, care must be taken that the gain controls are so set that the distortion does not arise primarily because of overloading of the electronics. This could happen, for example, because of an excessive input level compensated by a low setting of the recorder gain control or because of an excessive output level.

It is the condition when the distortion arises primarily in the record/replay processes that is usually referred to when the signal-to-noise ratio of a tape recorder is quoted.

Note 2: In the case of a tape recorder, there are several different signal-to-noise ratios that may be considered significant, according to circumstances, but in all cases it is necessary first to determine the output level at which the total harmonic distortion of a 1 kHz test signal is 2% (see (1), (2) and (3) above).

It is with this output level that the various noise levels are usually compared. (But see Note 3 below).

The signal-to-noise levels most usually quoted are those obtained by:—

- (a) recording and reproducing simultaneously with the input short circuited and using a bulk-erased or virgin tape.
- (b) as (a) but using a tape previously recorded to saturation level.
- (c) reproducing only, using a bulk-erased or virgin tape.
- (d) reproducing with the tape stationary.

In each case the noise level must be measured under the stated conditions.

Note 3: Signal-to-noise ratios are sometimes reckoned from the 3% rather than from the 2% total harmonic distortion level or from a specified tape flux level.

Note 4: Signal-to-noise ratio measurements are made with various types of meter (e.g. r.m.s. or peak indicating) sometimes with and sometimes without a frequency weighting. This Test Set measures unweighted noise using an average reading meter scaled in r.m.s. values for sinusoidal signals.

Note 5: When it is tape hiss or other high frequencies that are of most interest, it will usually be convenient to make the noise measurement with the "LF cut" button pressed down.

FERROGRAPH

RECORDER TEST SET

RTS2

3.7. Measurement of Gain

- (1) First proceed with steps (1), (2) and (3) of the procedure for measuring frequency response, 3.2. above.
- (2) Press the "MILLIVOLTMETER read input" button and then adjust the "MILLIVOLTMETER" switch to obtain a convenient reading on the meter.

This reading, in combination with the switch, indicates the output voltage of the equipment under test. (see Note to 2.2.).

- (3) Now, press the "MILLIVOLTMETER read osc" button. This releases the "read input" button and connects the meter to indicate the output voltage from the Test Set oscillator, that is to say the input voltage to the equipment under test.

- (4) Adjust the "MILLIVOLTMETER" switch to obtain a convenient reading on the meter.

This reading, in combination with the switch, indicates the input level to the equipment under test.

The ratio of the output level (2) above, to the input level (4) above, is the gain of the equipment. It may be expressed as a numerical ratio or in decibels.

Note: Gain can be measured at any frequency desired by an appropriate setting of the "FREQ" control and the range selecting push buttons below it. Care must be taken, however, to avoid overloading. (See Note 2 to 3.2. above.)

FERROGRAPH
RECORDER TEST SET
RTS2

Technical Specification

1. VARIABLE FREQUENCY TEST SIGNAL GENERATOR

Frequency Range

15 Hz to 150 kHz in four ranges.

Frequency Response

Flat within ± 0.2 dB over the range 15 Hz to 150 kHz.

Distortion

Less than 0.025% at 1 kHz

Less than 0.08% over the range 100 Hz to 20 kHz.

Maximum Output Level†

3 V (approx.) into open circuit

Not less than +8 dBm into 600 Ohm load

Output Attenuator

Coarse: Six steps of 10 dB

Fine: Continuous over range of 15 dB approx.

External: Fixed 40 dB

Output Impedance

Independent of frequency

Dependent on setting of output attenuator coarse control: always less than 450 ohms. From external 40 dB attenuator 47 ohms.

2. FIXED FREQUENCY TEST SIGNAL GENERATOR (FOR DRIFT AND WOW & FLUTTER MEASUREMENTS)

Frequency

3.15 kHz (RTS2A models, 3 kHz)

Output Level

350 mV approx.

Output Impedance

220 ohms approx.

3. MILLIVOLTMETER

Frequency Response

Flat within ± 0.2 dB over range 10 Hz to 150 kHz

Accuracy

Within $\pm 2\%$ f.s.d. over range 30 Hz to 20 kHz

Sensitivity

1 mV to 100 V f.s.d. in 11 steps of 10 dB

Input Impedance

2 Megohms (approx.)

Note: No D.C. path between the input leads.

Indication

Average reading meter scaled in r.m.s. values for sinusoidal signals.

†With the addition of a RTS Auxiliary Unit, up to +20 dB into 600 ohm load.

FERROGRAPH

RECORDER TEST SET RTS2

4. WOW AND FLUTTER METER

Type of Measurement

Meter measures peak wow and flutter weighted to D.I.N. 45507.

Input Signal Required

3.15 kHz (RTS2A models 3 kHz) at level not less than 75 mV.

Normally this is supplied by the Fixed Frequency Test Signal Generator of the Test Set itself (see 2 above).

If the test signal is from another source, e.g. a pre-recorded test disc or tape, then the frequency of the test signal should be within $\pm 5\%$ of the nominal value.

Sensitivity

Three ranges for wow and flutter measurements: 0.1%, 0.3% and 1% f.s.d.

One range, direct reading for drift measurements: $\pm 2\%$ f.s.d.

Input Impedance

50,000 ohms, approx.

Frequency Response for Wow and Flutter Measurements

Maximum at 4.0 Hz: 6 dB points at 0.8 Hz and 20 Hz

Alternative Output

The signal measured by the meter also appears on a BNC socket on the front panel and can be fed to an external oscilloscope, wave analyser, filters, etc.

The output level is 3 V (approx.) for meter f.s.d. from a source impedance of 15,000 ohms.

5. DISTORTION METER

Type of Measurement

Rejection of fundamental by a tuned filter.

Input Signal Required

Frequency within the range 400 to 1100 Hz (approx.). Signal normally supplied by the Variable Frequency Test Signal Generator (see 1, above).

The level of the signal from the equipment under test should be 100 mV or more. Smaller inputs may be used but with an increased minimum distortion reading.

Second Harmonic Rejection

Less than 0.25 dB

Minimum Reading (from a distortionless source)

Less than 0.05%

Bandwidth of Harmonic Distortion Measurement

15 Hz to 20 kHz

There is an optional L.F. cut (turnover 400 Hz) for the rejection of hum and other L.F. noise components.

FERROGRAPH

RECORDER TEST SET

RTS2

Input Impedance

100,000 ohms approx.

Alternative Output

The signal measured by the meter also appears on a BNC socket on the front panel and can be fed to an external oscilloscope, wave analyser, filters, etc.

The output level is 1 V (approx.) for meter f.s.d. from a source impedance of approximately 500 ohms.

6. GENERAL

Power Supply

105-120 V, 50 or 60 Hz or 200-250 V, 50 or 60 Hz ; 12 watts approx.

Dimensions

17 $\frac{1}{2}$ in. (441 mm) wide

10 in. (254 mm) deep over handles

5 $\frac{1}{2}$ in. (143 mm) high

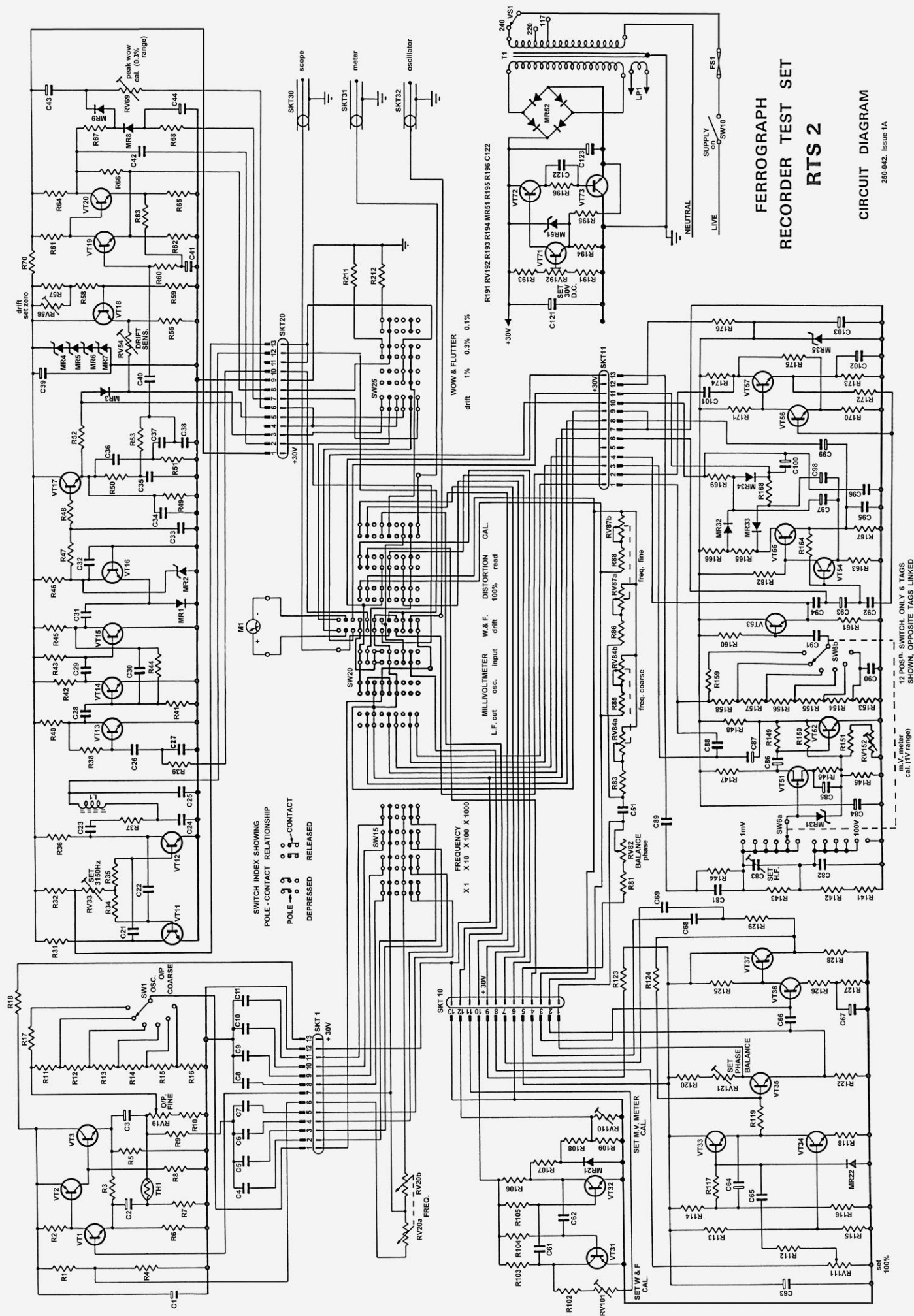
Weight

13 lb (5.9 kg) approx.

Access

Access to the inside of the case is obtained by removing two screws from the underside of the lip above the back panel.

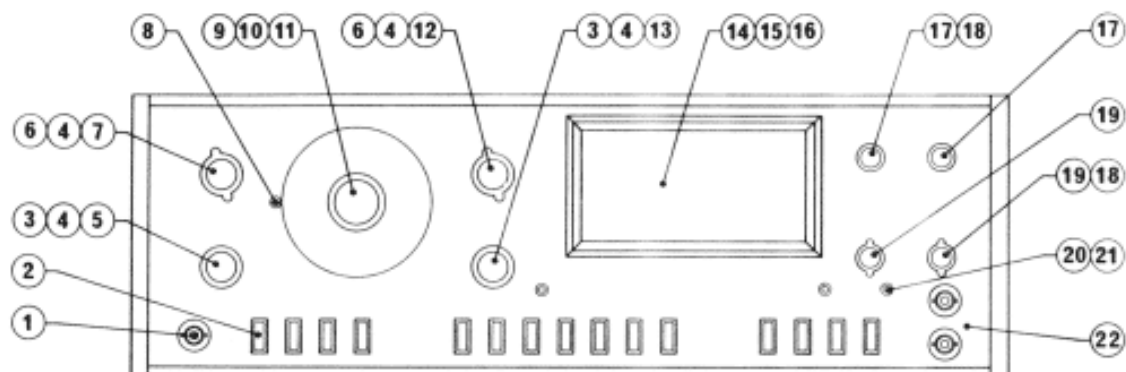
FERROGRAPH
RECORDER TEST SET
RTS2



FERROGRAPH

RECORDER TEST SET

Appendix

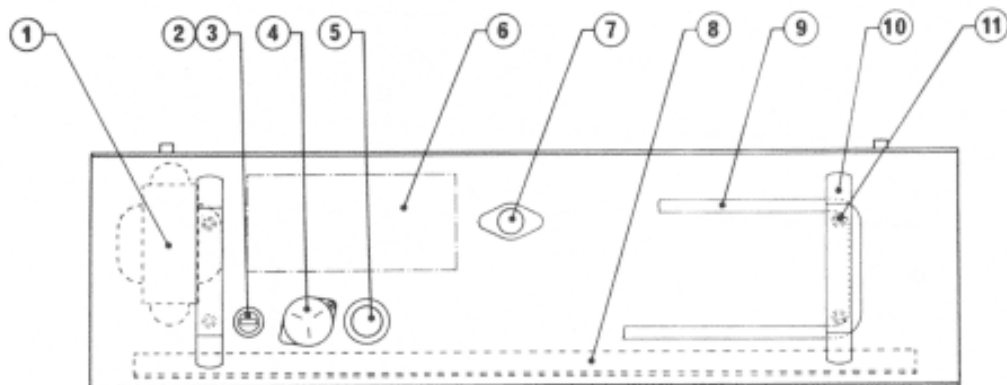


FRONT VIEW

Ref. Number	Item	Qty.	RTS 2 Part No.
1	Socket	3	692-030
2	Button	15	448-019
3	Knob K2	2	448-021
4	Bush	4	100-037
5	Extension Spindle	1	705-028F
6	Knob K2W	2	448-023
7	Extension Spindle	1	705-028D
8	Zero Stud	1	666-071
9	Knob K3	1	448-025
10	Dial	1	295-004
11	Potentiometer 10k Ω Logarithmic	1	582-033
12	Extension Spindle	1	705-028C
13	Extension Spindle	1	705-028E
14	Meter	1	512-005
15	Lamp Holder	1	455-008
16	Lamp Festoon 3W	1	455-010(12V)
17	Knob K1	2	448-022
18	Extension Spindle	2	705-028A
19	Knob K1W	2	448-026
20	Bush	3	100-038
21	Extension Spindle	3	705-029
22	Front Panel	1	573-178

FERROGRAPH

RECORDER TEST SET

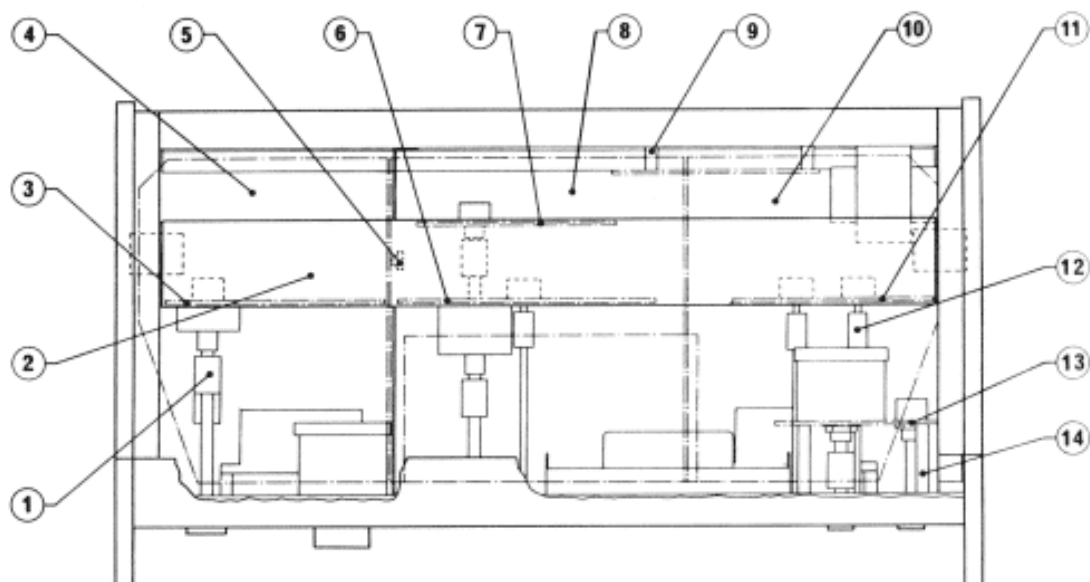


REAR VIEW

Ref. Number	Item	Qty.	RTS 2 Part No.
1	Mains Transformer	1	T1721
2	Fuse Holder	1	380-005
3	Fuse (0.75A, 20mm x 5mm dia.)	1	380-008
4	Voltage Selector	1	920-001
	Grommet	1	398-014
6	Power Board	1	025-310
7	Transistor (type 40312)	1	825-002
8	P.C. Board Support Bracket	1	025-255
9	Power Supply Lead	1	110-017
10	Cable Clip	2	196-011
11	Spacer	4	698-079

FERROGRAPH

RECORDER TEST SET

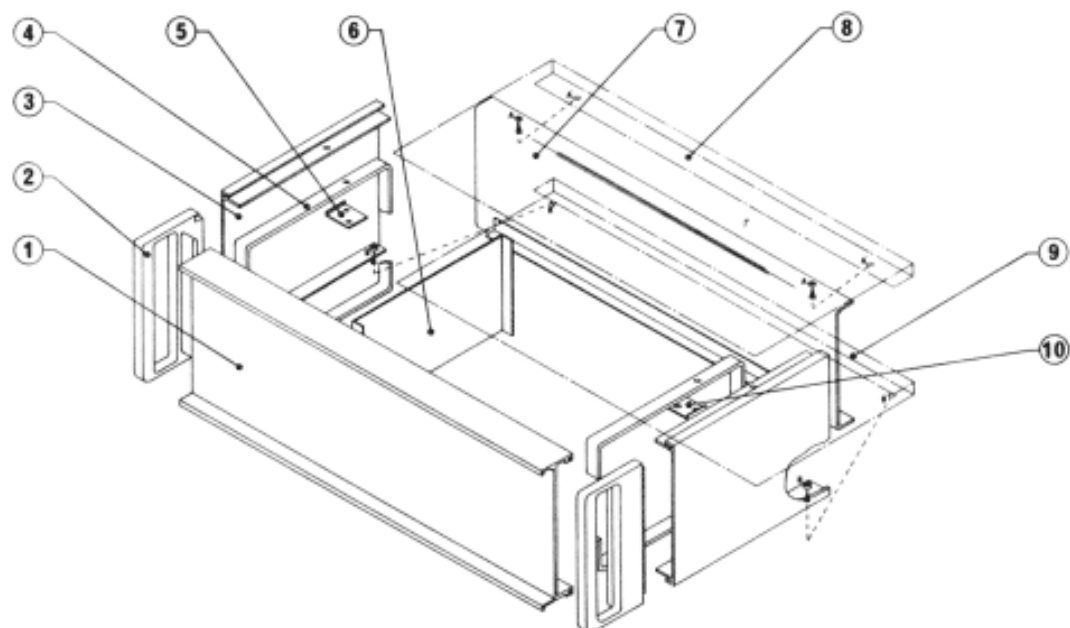


PLAN VIEW

Ref. Number	Item	RTS 2 Qty.	Part No.
1	Coupling	6	687-029
2	P.C. Board Fixing Strap	1	025-256
3	Oscillator Board	1	025-245
4	Oscillator Mother Board	1	025-247
5	Terminal Nut 4BA	1	BP/2025/N
6	Millivoltmeter Board	1	025-246
7	Distortion Meter Board	1	024-244
8	Millivoltmeter Mother Board	1	025-248
9	Spacer	9	698-068
10	Wow & Flutter Mother Board	1	025-311
11	Wow & Flutter Board	1	025-312
12	Coupling	3	202-005
13	Potentiometer Mounting Board	1	025-309
14	Spacer	4	698-069

FERROGRAPH

RECORDER TEST SET



EXPLODED VIEW

Ref. Number	Item	RTS2 Qty.	Part No.
1	Front Extrusion	1	573-180
2	Handle	2	412-002
3	Side Panel Extrusion	2	320-036
4	Hoop Frame	2	360-003
5	Bracket (top strap, L.H.)	1	025-254A
6	Screen	1	671-005
7	Rear Panel	1	573-177
8	Top Panel	1	573-143
9	Bottom Panel	1	573-144
10	Bracket (top strap, R.H.)	1	025-254B

FERROGRAPH

RECORDER TEST SET

List of Components

Cct. Ref.	OSCILLATOR BOARD	Part No.	Cct. Ref.	WOW & FLUTTER BOARD	Part No.
<u>Resistors(R) & Potentiometers(RV)</u>			<u>Resistors(R) & Potentiometers(RV)</u>		
R1	2.2k Ω $\frac{1}{2}$ W 1% High Stab.	625-24-2k2	R31	3.3k Ω $\frac{1}{2}$ W 5%	625-12-3k3
R2	15k Ω $\frac{1}{2}$ W 10%	625-13-15k	R32	1k Ω $\frac{1}{2}$ W 1% High Stab.	625-24-1k
R3	10k Ω $\frac{1}{2}$ W 5%	625-12-10k	RV33	22k Ω Linear SET 3150Hz	582-012
R4	1.8k Ω $\frac{1}{2}$ W 1% High Stab.	625-24-1k8	R34	430k Ω $\frac{1}{2}$ W 2% High Stab.	625-25-430k
R5	560 Ω $\frac{1}{2}$ W 5%	625-12-560	R35	430k Ω $\frac{1}{2}$ W 2% High Stab.	625-25-430k
R6	47k Ω $\frac{1}{2}$ W 10%	625-13-47k	R36	3.3k Ω $\frac{1}{2}$ W 5%	625-12-3k3
R7	680 Ω $\frac{1}{2}$ W 5%	625-12-680	R37	5.6k Ω $\frac{1}{2}$ W 5%	625-12-5k6
R8	47k Ω $\frac{1}{2}$ W 10%	625-13-47k	R38	10M Ω $\frac{1}{2}$ W 10%	625-13-10M
R9	1k Ω $\frac{1}{2}$ W 1% High Stab.	625-24-1k	R39	22k Ω $\frac{1}{2}$ W 10%	625-13-22k
R10	620 Ω $\frac{1}{2}$ W 5%	625-12-620	R40	47k Ω $\frac{1}{2}$ W 5% High Stab.	624-001
R11	1370 Ω $\frac{1}{2}$ W 0.2% High Stab.	624-015	R41	22k Ω $\frac{1}{2}$ W 10%	625-13-22k
R12	432 Ω $\frac{1}{2}$ W 0.2% High Stab.	624-014	R42	3.3k Ω $\frac{1}{2}$ W 5%	625-12-3k3
R13	137 Ω $\frac{1}{2}$ W 0.2% High Stab.	624-013	R43	390k Ω $\frac{1}{2}$ W 1% High Stab.	625-24-390k
R14	43.2 Ω $\frac{1}{2}$ W 0.2% High Stab.	624-012	R44	22k Ω $\frac{1}{2}$ W 10%	625-13-22k
R15	13.7 Ω $\frac{1}{2}$ W 0.2% High Stab.	624-011	R45	3.3k Ω $\frac{1}{2}$ W 5%	625-12-3k3
R16	6.34 Ω $\frac{1}{2}$ W 0.2% High Stab.	624-010	R46	22k Ω $\frac{1}{2}$ W 1% High Stab.	625-24-22k
R17	100 Ω $\frac{1}{2}$ W 5%	625-12-100	R47	39k Ω $\frac{1}{2}$ W 5%	625-12-39k
R18	100 Ω $\frac{1}{2}$ W 5%	625-12-100	R48	56k Ω $\frac{1}{2}$ W 10%	625-13-56k
RV19	2.2k Ω Linear (OUTPUT - fine)	582-035	R49	22k Ω $\frac{1}{2}$ W 10%	625-13-22k
<u>Capacitors</u>			R50	1k Ω $\frac{1}{2}$ W 10%	625-13-1k
C1	3300 μ F 40V Electrolytic	130-024	R51	620 Ω $\frac{1}{2}$ W 5%	625-12-620
C2	125 μ F 16V Electrolytic	130-002	R52	2.2k Ω $\frac{1}{2}$ W 1% High Stab.	625-24-2k2
C3	125 μ F 16V Electrolytic	130-002	R53	1k Ω $\frac{1}{2}$ W 10%	625-13-1k
C4	950pF 30V 2 $\frac{1}{2}$ %	131-775	RV54	1k Ω Linear DRIFT SENS.	582-032
C5	0.01 μ F 30V 2 $\frac{1}{2}$ %	131-774	R55	22k Ω $\frac{1}{2}$ W 10%	625-13-22k
C6	0.1 μ F 160V 1%	131-514	RV56	25k Ω Linear drift set zero	582-031
C7	1 μ F 160V 1%	131-515	R57	22k Ω $\frac{1}{2}$ W 1% High Stab.	625-24-22k
C8	1 μ F 160V 1%	131-515	R58	33k Ω $\frac{1}{2}$ W 1% High Stab.	625-24-33k
C9	0.1 μ F 160V 1%	131-514	R59	33k Ω $\frac{1}{2}$ W 1% High Stab.	625-24-33k
C10	0.01 μ F 30V 2 $\frac{1}{2}$ %	131-774	R60	100k Ω $\frac{1}{2}$ W 5% High Stab.	624-002
C11	950pF 30V 2 $\frac{1}{2}$ %	131-775	R61	220k Ω $\frac{1}{2}$ W 5%	625-12-220k
<u>Miscellaneous</u>			R62	1.6k Ω $\frac{1}{2}$ W 1% High Stab.	625-24-1k6
VT1	Transistor BC183LB	825-015	R63	1M Ω $\frac{1}{2}$ W 10%	625-13-1M
VT2	Transistor BC184LB	825-016	R64	4.7k Ω $\frac{1}{2}$ W 5%	625-12-4k7
VT3	Transistor BC183LB	825-015	R65	390 Ω $\frac{1}{2}$ W 1% High Stab.	625-24-390
SW1	Switch (OSC. OUTPUT coarse)	750-013	R66	100k Ω $\frac{1}{2}$ W 5% High Stab.	624-002
TH1	Thermistor ITT-R25	800-000	R67	1.6k Ω $\frac{1}{2}$ W 1% High Stab.	625-24-1k6
<u>FRONT PANEL</u>			R68	56k Ω $\frac{1}{2}$ W 10%	625-13-56k
<u>Potentiometers</u>			RV69	25k Ω Linear peak wow cal.	582-031
RV20a	10k Ω Log.) (FREQ.)	582-033	R70	470 Ω $\frac{1}{2}$ W 10%	625-13-470
RV20b	10k Ω Log.)		<u>Capacitors</u>		
<u>Miscellaneous</u>			C21	1000pF 63V 2 $\frac{1}{2}$ %	131-768
M1	Meter (Sifam 100 μ A)	512-005	C22	1000pF 63V 2 $\frac{1}{2}$ %	131-768
LP1	Lamp 12V, 3W	455-010	C23	0.22 μ F 100V 10%	131-253
SKT30	Socket BNC (1637/CS)	692-030	C24	0.22 μ F 100V 10%	131-253
SKT31	Socket BNC (1637/CS)	692-030	C25	0.33 μ F 100V 10%	131-257
SKT32	Socket BNC (1637/CS)	692-030	C26	950pF 63V 2 $\frac{1}{2}$ %	131-775
			C27	950pF 63V 2 $\frac{1}{2}$ %	131-775
			C28	950pF 63V 2 $\frac{1}{2}$ %	131-775
			C29	950pF 63V 2 $\frac{1}{2}$ %	131-775

FERROGRAPH

RECORDER TEST SET

List of Components

Cct. Ref.	WOW & FLUTTER BOARD	Part No.	Cct. Ref.	POT. MOUNTING BOARD	Part No.
<u>Capacitors</u>			<u>Capacitors</u>		
C30	950pF 63V	2½% 131-775	C51	0.033µF 250V 1%	131-260
C31	0.01µF 30V	2½% 131-774	<u>Miscellaneous</u>		
C32	0.047µF 250V	10% 131-256	SW10	Switch SUPPLY on	750-004
C33	0.22µF 100V	10% 131-253	<u>Resistors(R) & Potentiometers(RV)</u>		
C34	0.22µF 100V	10% 131-253	RV101	22kΩ Linear SET W&F CAL	582-012
C35	0.1µF 100V	10% 131-250	R102	47kΩ ½W 5% High Stab.	624-001
C36	0.047µF 250V	10% 131-256	R103	47kΩ ½W 5% High Stab.	624-001
C37	0.047µF 250V	10% 131-256	R104	360kΩ ½W 1% High Stab.	625-24-360k
C38	0.047µF 250V	10% 131-256	R105	360kΩ ½W 1% High Stab.	625-24-360k
C39	25µF 25V Electrolytic	130-016	R106	18kΩ ½W 10%	625-13-18k
C40	1µF 250V 10%	131-259	R107	4.7kΩ ½W 1% High Stab.	625-24-4k7
C41	25µF 25V Electrolytic	130-016	R108	10kΩ ½W 1% High Stab.	625-24-10k
C42	0.22µF 100V 10%	131-253	R109	6.8kΩ ½W 1% High Stab.	625-24-6k8
C43	12.5µF 25V Electrolytic	130-026	RV110	22kΩ Linear SET mVmeter CAL	582-012
C44	12.5µF 25V Electrolytic	130-026	RV111	100kΩ Log. set 100%	582-036
<u>Miscellaneous</u>			R112	1kΩ ½W 10%	625-13-1k
VT11	Transistor BC184LC	825-005	R113	22kΩ ½W 1% High Stab.	625-24-22k
VT12	Transistor BC184LC	825-005	R114	33kΩ ½W 1% High Stab.	625-24-33k
VT13	Transistor BC184LC	825-005	R115	1.8kΩ ½W 5%	625-12-1k8
VT14	Transistor BC183LB	825-015	R116	22kΩ ½W 1% High Stab.	625-24-22k
VT15	Transistor BC183LB	825-015	R117	47kΩ ½W 5% High Stab.	624-001
VT16	Transistor BC183LB	825-015	R118	100Ω ½W 5%	625-12-100
VT17	Transistor BC184LC	825-005	R119	3.3kΩ ½W 5%	625-12-3k3
VT18	Transistor BC184LC	825-005	R120	1.8kΩ ½W 1% High Stab.	625-24-1k8
VT19	Transistor BC184LC	825-005	RV121	1kΩ Linear SET PHASE BAL.	582-032
VT20	Transistor BC183LB	825-015	R122	1kΩ ½W 1% High Stab.	625-24-1k
MR1	Diode MAX16	290-001	R123	1.8kΩ ½W 5%	625-12-1k8
MR2	Zener Diode BZY88C12	290-017	R124	39kΩ ½W 10%	625-13-39k
MR3	Diode NKT 249A30	290-015	R125	100kΩ ½W 5% High Stab.	624-002
MR4	Zener Diode BZY88C5V6	290-013	R126	270Ω ½W 5%	625-12-270
MR5	Zener Diode BZY88C4V7	290-016	R127	47kΩ ½W 5% High Stab.	624-001
MR6	Zener Diode BZY88C4V7	290-016	R128	10kΩ ½W 10%	625-13-10k
MR7	Zener Diode BZY88C4V7	290-016	R129	1.5kΩ ½W 5%	625-12-1k5
MR8	Diode NKT 249A30	290-015	<u>Capacitors</u>		
MR9	Diode NKT 249A30	290-015	C61	0.1µF 100V 10%	131-250
L1	Coil	Spec. 800	C62	0.1µF 100V 10%	131-250
Cct. Ref.	POT. MOUNTING BOARD	Part No.	C63	640µF 25V Electrolytic	130-004
<u>Resistors(R) & Potentiometers(RV)</u>			C64	25µF 25V Electrolytic	130-016
R81	10kΩ ½W 1% High Stab.	625-24-10k	C65	0.47µF 250V 10%	131-258
RV82	2kΩ 10 turn BALANCE phase	582-056	C66	0.033µF 250V 10%	131-255
R83	3.9kΩ ½W 5%	625-12-3k9	C67	25µF 25V Electrolytic	130-016
RV84a	10kΩ Log. (freq. coarse)	582-033	C68	4700pF 30V 2½%	131-778
RV84b	10kΩ Log. (freq. fine)	582-034	C69	0.47µF 250V 10%	131-258
R85	3.9kΩ ½W 5%	625-12-3k9			
R86	330kΩ ½W 5%	625-12-330k			
RV87a	100kΩ Log. (freq. fine)	582-034			
RV87b	100kΩ Log. (freq. coarse)	582-033			
R88	330kΩ ½W 5%	625-12-330k			

List of Components

7

FERROGRAPH

RECORDER TEST SET

List of Components

Cct. Ref.	POWER BOARD	Part No.	Cct. Ref.	W & F MOTHER BOARD	Part No.
	<u>Capacitors</u>				
C121	100 μ F 40V Electrolytic	130-001	R211	680 Ω $\frac{1}{2}$ W 1% High Stab.	625-24-680
C122	0.01 μ F 100V 10%	131-500	R212	137 Ω $\frac{1}{2}$ W 0.2% High Stab.	624-013
C123	250 μ F 64V Electrolytic	130-010	SW25	Push Button Switch W & F	749-005
	<u>Miscellaneous</u>		SKT20	P.C. Board Socket - 26 way	692-029
VT71	Transistor BC183LB	825-015			
VT72	Transistor BC461	825-032	Cct. Ref.	OSCILLATOR MOTHER BOARD	Part No.
MR51	Zener Diode BZY 88C 5V6	290-013	SW15	Push Button Switch FREQUENCY	749-005
MR52	Bridge Rectifier WO2	600-002	SKT1	P.C. Board Socket - 26 way	692-029
Cct. Ref.	REAR PANEL	Part No.			
VT73	Transistor 40312	825-002	Cct. Ref.	MILLIVOLTMETER MOTHER BD.	Part No.
T1	Transformer, Power Supply	T1721	SW20	Push Button Switch	749-003
FS1	Fuse 0.75A, 20mm x 5mm dia.	380-008	SKT10	P.C. Board Socket - 26 way	692-029
VS1	Voltage Selector	920-001	SKT11	P.C. Board Socket - 26 way	692-029

REPLACEMENT BOARD SERVICE

Where it is found necessary to change an electronic component, the RTS2 should be checked and re-calibrated using test equipment which is several times more accurate than the Test Set itself. If this equipment is not available or if difficulty is experienced, the relevant P.C. board(s) can be sent for checking or replacement to the Ferrograph 'Replacement Board Service'.

When returning the board(s) to the appropriate overseas agent, or in the U.K. to the South Shields Service Department, it is essential to include the SERIAL NUMBER of the Test Set.